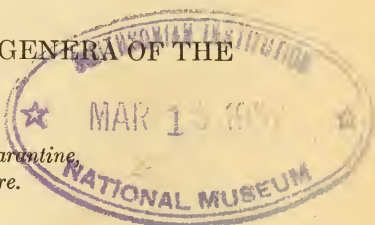


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SYNONYMY AND SYNOPSIS OF THE GENERA OF THE
ORDER PROTURA.

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Since Berlese published his extensive monograph on the Protura (Myrientomata) in 1909 our knowledge of the primitive hexapods of this order has been greatly extended. The literature dealing with them has increased until now there are over seventy titles. Berlese's monograph was based on ten species, all European. According to a recent catalogue of the group (Mills, 1932) forty-three species are known, coming from many parts of the world. As our knowledge of the group has increased the need of a reexamination of the type species of certain genera and of a reevaluation of the generic and specific characters has become evident.

Generic revision already has been started in the first of a series of notes on the Protura by Bagnall (1936). He states:

"In my first contribution I am able to reinstate the genus *Proturentomon* of Silvestri and to unravel a consequent somewhat complicated synonymy." The synonymy as given by this author is as follows (Bagnall, 1936, p. 212):

"Genus *Proturentomon* Silv. 1909, p. 10.

Syn.: *Acerentulus* auct., pp.

Protentomon Ewing, 1921, p. 195.

Meroentomon Womersley, 1927, p. 145.

Paraentomon Womersley, 1927, p. 145."

Unfortunately certain pertinent literature apparently was overlooked by this author, no mention being made of Tuxen's (1931) "Monographie der Proturen" or Mills' (1932) "Catalogue of the Protura."

The present writer feels that answers to some of the problems raised by Bagnall are given in the papers quoted—for example, his statement that Womersley showed that the name *Protentomon* Ewing was preoccupied. This is answered by Mills (1932, p. 126) as follows:

"The change of the generic name *Protentomon* Ewing to *Meroentomon* and the erection of the subfamily Meroentomoninae on the latter by Womersley is not tenable. The term *Protentomon* was used by Mayer (*vide* Imms' Textbook of Entomology, 2d edition, p. 3, 1929) as a name for a hypothetical, composite, non-existent, archetypic insect and not in a generic sense, and thus can not conflict with the name of Ewing's genus. The name *Protentomon* is restored in the following list and the subfamily name Protentomoninae replaces Meroentomoninae."

The point involved is covered by Opinion 2 of the International Commission on Zoological Nomenclature, the summary of which reads in part as follows:

"Names based upon hypothetical forms have, therefore, no status in nomenclature and are not in any way entitled to consideration under the Law of Priority."

In order properly to review the generic problems in the Protura, first let us go back to 1909 when Silvestri erected his genus *Proturentomon*, apparently unaware of Berlese's genus *Acerentulus* which was erected at about the same time.

Proturentomon Silvestri (1909).

Silvestri (1909) divided his previously established genus *Acerentomon* into two genera, proposing as new *Proturentomon* with *Acerentomon minimum* Berlese as type species. This new genus was stated to differ from *Acerentomon* (*sensu stricto*) in having the head subrotund in front instead of having it prolonged into a rostrum and in lacking the pair of pectinate laminae (pectines) on the eighth abdominal segment.

Berlese's monograph (1909) on the Protura (Myrientomata) appeared the same year, containing a good description and good figures of *Acerentomon minimum* which showed that it possesses an apically angulate rostrum and a pair of pectinate laminae on segment eight of the abdomen.

In this monograph Berlese (1909) included the type species of Silvestri's genus *Proturentomon*, *Acerentomon minimum* Berlese, in his previously established genus *Acerentulus*. Since in this monograph Berlese's very excellent drawings and description of this type species show that it does not possess the characters upon which the genus *Proturentomon* was based, but rather those of his own genus *Acerentulus*, subsequent workers have been inclined to regard *Proturentomon* as a synonym of *Acerentulus* until its recent reestablishment by Bagnall (1936).

Berlese's descriptions and copious figures of the type species of *Acerentulus* and *Proturentomon* show that the type of *Proturentomon*, *Acerentomon minimum* Berlese, differs from the type of *Acerentulus*, *Acerentomon confine* Berlese, in several basic characters:

(a) The terga of the typical abdominal segments of *Acerentomon minimum* are without transverse grooves, instead of each having two transverse grooves.

(b) The typical abdominal segments are each provided with a single transverse row of dorsal setae and an anterior submedian pair, instead of two transverse rows of dorsal setae.

(c) The tergal apodemes of the typical abdominal segments are broadly rounded near the median line and narrowly branched laterally, instead of being angulate submedially and broadly branched dorsolaterally.

(d) The rostrum is present instead of absent.

Thus *Proturentomon* is really very different from *Acerentulus* Berlese.

Acerella Berlese (1909).

Berlese divided his genus *Acerentulus* into two subgenera, proposing as new *Acerella* based on *Acerentulus tiarneus* Berlese. This subgenus has a rather doubtful status. Its type species needs redescription. Berlese placed *Acerentulus tiarneus* in a new subgenus because the dorsal abdominal apodemes are but slightly incurved, while in all the other species of *Acerentulus* then known to him these apodemes are strongly incurved. Using this character alone it would be impossible to-day to determine which of the known species of *Acerentulus* should be allocated to *Acerella*.

It appears to the present writer more significant that the dorsal apodemes of *Acerentulus tiarneus* do not branch than that they are only slightly incurved. Also it is noted that Berlese does not figure the pectines on abdominal segment VIII. If these pectines are really absent in this species, this fact should do much toward reestablishing *Acerella* either as a subgenus or as a genus.

Protapteron Schepotieff (1909).

Schepotieff (1909) established the genus *Protapteron*, founded on a proturan, *P. indicum* Schepotieff, from India, that was reported to be remarkable in certain respects for a member of this order. It was described and figured as having long, many-segmented antennae.

Fortunately Rimsky-Korsakow (1911) reexamined a type of *P. indicum* and reported it to be a species typical of *Eosentomon*. This discovery of Rimsky-Korsakow, together with the discovery of evident misinterpretations by Schepotieff, have caused most workers to accept the synonymy of *Protapteron* with *Eosentomon*. Despite all this Womersley (1932) still recognizes Börner's family Protapteridae, based on *Protapteron*, in his classification of the Protura.

Womersley (1928) had previously expressed the view that Schepotieff probably had two species before him at the time he described his *indicum*, and that the specimen examined by Rimsky-Korsakow did not represent the species actually described by Schepotieff. That any one could confuse a proturan which has no antennae with one that has long, many-segmented antennae does not appear reasonable.

But Schepotieff's description and figures of *P. indicum* give evidence of poor preparation of material and misinterpretation of structures. This statement is here made only in the light of an abundance of morphological work done by various other investigators since Schepotieff's paper was published. It is to be noted that Schepotieff does not represent the pseudoculi on his *Protapteron indicum*, structures rather conspicuous and invariably present dorsolaterally on the Proturan head; that he describes as a

one-segmented appendage on abdominal segment IV the projecting posterolateral corner of the sternal plate (a structure easily mistaken for a one-segmented vestigial appendage in the Protura), that the openings of the abdominal glands between abdominal segments VIII and IX (secretions of which can easily be forced to the exterior) are described as the genital openings, that the maxillae are not properly figured or described as representative of Protura, yet characters are given that identify them as Proturan maxillae.

Until type material is found that will substantiate the very unusual claims for *P. indicum*, we must accept the finding of Rimsky-Korsakow. He alone has reexamined a type of the supposedly anomalous species.

Protentomon Ewing (1921).

As pointed out by Mills (1932, p. 126) *Protentomon* is not preoccupied as claimed by Womersley (1927a, p. 141). The reexamination of the generic characters of its type, *Protentomon transitans* Ewing, as has been noted in this paper, proves the genus to be distinct.

Berlese (1909) called attention to the particular form of the front tarsi and their specialized sensory setae in *Acerentomon minimum*. A reexamination of tarsus I of *Protentomon transitans* reveals the presence of a dorsal sensory seta. However, the tarsal claw apparently is accompanied by a ventral vestigial claw as in species belonging to other genera.

The type of *Protentomon* differs from the type of *Proturentomon* in the characters given in the appended key to the genera.

Acerentuloides Ewing (1921).

Womersley (1927b) has expressed the belief that the genus *Acerentuloides* is based on immature specimens. A reexamination of the holotype of the type species, *A. bicolor* Ewing, shows it to be, as originally stated (Ewing 1921), a female. It has twelve abdominal segments and a well-formed genital armature. This species is a common one at Takoma Park, Maryland, where the writer has lived for many years.

Microentomon Ewing (1921).

Womersley (1927b) states in regard to *Microentomon minutum* Ewing, the designated type species of *Microentomon*, that "it is quite impossible to accept Ewing's species as the genotype owing to his type being immature." Again this authority insists on not following the rules of nomenclature. The reasons for selecting this species as type of the writer's genus *Microentomon* were explained when the genus was established (Ewing, 1921) as follows: "The species is probably very common, but is not usually observed because of its minute size and habits. Three mounted specimens are at hand, all of which lack the complete number of segments and the genital papilla hence are not mature. The generic characters of these specimens agree exactly with those of the single female found by Berlese. Because of its common occurrence it appears desirable to make this species the type of the genus, notwithstanding the fact that the mature

form has not yet been taken. I have frequently observed live specimens of the species and studied them alive in the laboratory."

The characters of *Microentomon* are worthy of further consideration. Berlese (1909) apparently assumed that the vestigial abdominal appendages of *Microentomon perpusillus* (Berlese) were: I, 2-segmented; II, 1-segmented; III, 1-segmented. On reexamination of the type species of *Microentomon* the writer finds that apparently they are thus segmented. Also it is observed that the front tarsi are without sensory setae.

The genus *Microentomon* should be included in the subfamily Protentominae and this group should be raised to full family rank as is done in the following key.

In the characters of the terga as well as those of the vestigial abdominal appendages and the pectines members of this new family approach in varying degrees the family Eosentomidae. They constitute in a way a connecting link between the two original families of Protura, the Eosentomidae and the Acerentomidae.

Meroentomon Womersley (1927).

As has been shown at the beginning of this paper, *Meroentomon* was proposed in error to take the place of *Protentomon* Ewing. The latter generic name is not preoccupied according to Opinion 2 of the International Commission on Zoological Nomenclature. *Meroentomon* therefore becomes a synonym of *Protentomon*.

Paraentomon Womersley (1927).

Womersley (1927a) erected the genus *Paraentomon* with *P. clevedonense* Womersley as the type. This genus he differentiated from *Protentomon* Ewing (the name of which he erroneously claimed to be preoccupied) by the presence of abdominal tergal apodemes, the presence of an anterior pair of submedian fine setae on certain abdominal segments (VIII and VI-I), and the presence of a pair of modified pectines on abdominal segment VIII.

Bagnall (1936, p. 211) rejects Womersley's genus *Paraentomon* largely on his belief that the type species of *Protentomon*, *P. transitans* Ewing, possesses the anterior pairs of submedian fine setae and that the absence of the pectines on abdominal segment VIII was due to the type specimen being immature.

In order to determine properly the characters of *Protentomon transitans* which are in dispute, the writer has reexamined the type specimen in the U. S. National Museum, using an oil-immersion lens. The results follow:

1. The specimen is undoubtedly mature, having twelve well-formed abdominal segments and a conspicuous genital armature.

2. As suspected by Bagnall, the anterior pairs of submedian fine setae are present, being visible on abdominal segments III, V, VI, and VII. There is also a probability of the existence of pairs of certain very fine setae that could not be detected on certain other segments.

3. Vestigial pectines are present on abdominal segment VIII.

4. The rostrum is absent.

When Bagnall (1936) reestablished the genus *Proturentomon* Silvestri (1909), he claimed that *Paraentomon* Womersley (1927a) was established on a species, *P. clevedonense* (1927a), which is only a synonym of the type species of *Proturentomon*. He further believes that Berlese (1909) did not properly examine the abdominal appendages of *Acerentomon minimum*, the type species of *Proturentomon*, and that this species should not have been included in a group in which the first alone of the appendages is two-segmented. Whether or not *Paraentomon clevedonense* Womersley is a synonym of *Acerentomon minimum* Berlese, it appears evident that the two species must be considered congeneric and *Paraentomon* a synonym of *Proturentomon*.

An annotated list of all the genera proposed in the Order Protura follows:

- Acerentomon* Silvestri (1907). Valid. Oldest genus.
Eosentomon Berlese (1908). Only genus proposed in the family Eosentomidae. Valid.
Acerentulus Berlese (Dec. 1908). Valid.
Proturentomon Silvestri (Jan. 1909). Long considered as a synonym of *Acerentulus* Berlese. Reinstated by Bagnall (1936). Valid.
Acerella Berlese (1909). Proposed as a subgenus of *Acerentulus*. Not recognized since except as a synonym of *Acerentulus*. Characters of type species need restudying before true status can be determined.
Protapteron Schepotieff (1909). Based apparently on fictitious characters. Synonym of *Eosentomon*.
Protentomon Ewing (1921). Claimed in error by Womersley to be preoccupied. Valid.
Acerentuloides Ewing (1921). Valid.
Microentomon Ewing (1921). Not accepted by Womersley because type species was described from nymphs. Is valid under the rules.
Meroentomon Womersley (1927). Synonym of *Protentomon* Ewing, for which it was proposed in error as a new name.
Paraentomon Womersley (1927). Claimed by Bagnall to be based on a species which is only a synonym of the type species of the older and previously suppressed genus *Proturentomon* Silvestri. Equals *Proturentomon* Silvestri.

There is here appended a key to the valid genera and higher groups of the Order Protura.

KEY TO THE GENERA AND HIGHER GROUPS OF PROTURA.

- A. Tracheae present, opening through two pairs of spiracles, one on mesothorax and one on metathorax; all vestigial abdominal appendages 2-segmented; segment VIII of abdomen without pectines.....*EOSENTOMIDAE* Berlese
 Contains but a single genus.....*Eosentomon* Berlese
 AA. Tracheae and spiracles absent; vestigial abdominal appendage III, 1-segmented; segment VIII of abdomen usually with a pair of pectines.

- B. Abdominal terga without transverse grooves and laterotergites; typical abdominal segments with but a single transverse row of dorsal setae; pectines of abdominal segment VIII reduced or absent.....
 PROTENTOMIDAE, new family
- C. Vestigial abdominal appendage II, 2-segmented; segment VIII of abdomen with pectines; front tarsi with sensory setae.
- D. Dorsal abdominal apodemes absent; rostrum absent....
Protentomon Ewing
- DD. Dorsal abdominal apodemes present; rostrum present..
Proturentomon Silvestri
- CC. Vestigial abdominal appendage II, 1-segmented; segment VIII of abdomen without pectines; front tarsi without sensory setae*Microentomon* Ewing
- BB. Typical abdominal terga, each with 1 or 2 transverse grooves and a pair of laterotergites; typical abdominal segments with two complete transverse rows of dorsal setae; pectines on abdominal segment VIII not reduced.....
 ACERENTOMIDAE Berlese
- C. Labrum (rostrum) long, narrow, very acute.....
Acerentomon Silvestri
- CC. Labrum very short or absent.
- D. Tergal plates of thorax and abdomen well sclerotized; dorsal abdominal apodemes present ..*Acerentulus* Berlese
- DD. Tergal plates of thorax and abdominal segment I hyaline, non-sclerotized; dorsal abdominal apodemes absent.....*Acerentuloides* Ewing

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